

II.—DIPTEROUS LARVÆ FROM THE WESTERN ALKALINE LAKES AND THEIR USE AS HUMAN FOOD. By S. W. WILLISTON.

THROUGH the kindness of Professors G. J. Brush and S. I. Smith I have recently received a quantity of the larvæ and imagos of a dipterous insect that is of interest not only as one of the very few inhabitants of the strongly alkaline lakes of the West, but as forming an article of human food, the only instance that I am aware of in this order of insects. The specimens, belonging to the genus *Ephydra*, were received with a quantity of the rare mineral Gay-lussite from the Soda Lakes near Ragtown, Nevada. I find the following description of the larger lake by Arnold Hague in King's Descriptive Geology, vol. ii, pp. 746-749.

"The lake is about five-eighths of a mile in diameter, with water of a clear blue color, it has no outlet and is fed by a spring of cool fresh water. The water is highly charged with alkaline salts and is so dense that the human body floats in it without exertion, and, after drying, the skin is left with a thin white covering.

"The water appears to be wanting in animal life, with the exception of a minute fly, the larva of which is a small worm, accumulating in such large quantities as to form a belt a foot wide along the shore. It is occasionally gathered by the Pah-Ute Indians, and, after drying and pulverizing, made into a sort of meal or flour." From analyses of the water made by Professor Allen its specific gravity is 1.0975, the fixed residue in 1,000 parts being 114.7. This residue consists of common salt, 64.94; sulphate of soda (Glauber's salts), 13.76; carbonate of soda, 29.24; sulphate of potash, carbonate of magnesia, etc., 4.63.

By comparison of these larvæ with a number collected by Professor Silliman, from Lake Mono, and kindly lent me by Professor Verrill, I find them apparently quite the same. At my request Professor Wm. H. Brewer has kindly given me the following description of the lake and the flies, which will be read with interest.

"MY DEAR SIR:"

"You asked about the flies from Lake Mono, and, although I have a sufficiently vivid recollection of them, I have turned to a file of old letters written to my friends at home at the time and on the spot."

“At the time, I was first assistant on the State Geological Survey of California, and had charge of a party doing field work. In this work I camped with my party at Lake Mono, July 9th, 1863, and remained there several days visiting the islands in the lake, also a camp of Indians (July 11th) who were camped on the north shore gathering *koo-chah-bee*. Our guide called them Pah-Utes and said they were there at that particular time gathering the worms—an annual visit. They were one of the small tribes of Mono Indians (we saw others, also Monos) there for that purpose, the guide using the term Pah-Utes as a sort of generic term, including many of the Indians of the Basin.

“My letter, written on the spot, tells that it is a closed basin, altitude about 6,800 feet; the waters very saline from various salts, impregnated with soda, borax, and boracic acid, the latter doubtless from the hot springs in and about it. It is in a volcanic region. ‘The waters are clear, *very* heavy, have a nauseous taste, and when still, the lake has a look as of oil and is not easily disturbed. The water feels slippery to the touch, and will wash grease from the hands or from clothes, cold, more readily than common soap-suds will when hot. It is said that no fish or reptile lives in it, but it swarms with countless millions of larvæ, that develop into flies which rest on the surface of the water, as well as cover everything on the immediate shore. The number and quantities of these flies and larvæ are absolutely incredible. They drift up in heaps along the shore, and *hundreds of bushels* could be collected! They only grow at certain seasons of the year, and then Indians come from far and near to gather them for food. The worms are dried in the sun, the shell rubbed off by hand, when a yellowish kernel remains, like a small yellowish grain of rice. This is oily, very nutritious and not unpleasant to the taste, and, under the name of *koo-chah-bee* (so pronounced), forms a very important article of food. The Indians gave me some of it; it does not taste badly, and, if one were ignorant of its origin, it would make nice soup.’ It tastes more like patent ‘meat biscuit’ than anything else I can compare it with.

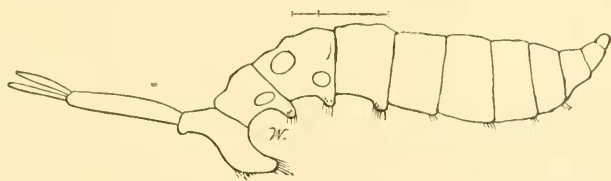
“I will say in addition that *koo-chah-bee* was rather palatable. The waves cast these larvæ in little windrows on the shore; the quantity is large, the chief difficulty in collecting is to get it as free from sand as is possible, and it is then dried on clothing or blankets. My guide, an old hunter there, told me that everything fattens in the season of the *koo-chah-bee*; that ducks get very fat, but their flesh

tastes unpleasantly from it, and that the Indians get fat and sleek. There are many gulls about the lake at that season.

“The flies settle on twigs, spires of grass, etc., until nothing of the perch can be seen, merely a wand of closely clinging flies. They also at times rest on the water in great numbers.”

In addition to these larvæ a Phyllopod crustacean belonging to the genus *Artemia* (*A. Monica* Verrill) is, according to Professor Verrill, found in large numbers in the waters of Lake Mono. This genus, like *Ephydra*, is, as stated by Professor Verrill, “remarkable for its habit of living and flourishing best in very saline and alkaline waters such as the natural salt lakes of Egypt, Utah, etc., and artificial brines.” (Am. Jour. Sci., xviii, p. 244, 1869, and Proc. Am. A. S., 1869.)

The fly is small, black, and scarcely more than the sixth of an inch in length. It belongs to the genus *Ephydra*, the larvæ of many species of which are known to inhabit saline or alkaline waters. The present species is perhaps new, but in deference to the opinion of Professor Packard, who compared these same Mono Lake larvæ with the larvæ he described and named from Clear Lake, California, I here describe the adult fly for the first time under the name of *E. Californica* Pack. In a large number of larvæ examined the differences were slight, the one here figured being one of the more slender.



Larva of *Ephydra* (?) *Californica*.

By comparison with the figure given of *E. Californica* (Am. Jour. Sci., 3d ser., vol. i, p. 103) differences will be apparent. It differs from the description in that the anterior end tapers abruptly, not gradually, and the end is not truncate; the first four abdominal legs are scarcely apparent, their presence being only indicated by the short bristly hooklets. Their identity will only be determined by the comparison of the adults from Clear Lake. The description of the fly from the Soda Lakes is as follows:

Ephydra Californica.

? *Ephydra Californica* Packard, Am. Jour. Sci., 3d ser., vol. i, 103, 1871 (described in the larval and pupal stages only).

♂ ♀. Black, nearly opaque; third joint of antennæ without lateral pile, arista pubescent; epistoma of female with numerous lateral bristly hairs; in the male nearly bare. Length $3\frac{1}{4}$ – $3\frac{1}{2}$ ^{mm}.

Black, very slightly shining, nearly opaque, lightly cinereous pollinose, on the face somewhat ochraceous, apparently the same in both sexes. Front, except the lateral margins, shining, slightly greenish. Antennæ black, third joint bare, arista pubescent. Face with its greatest convexity in the lower part, in the females the sides above the oral margin with numerous long, black bristly hairs, in the male the face is almost wholly bare, except some short hairs in the middle above. Legs black, cinereous pollinose, the anterior and posterior tarsi with golden pubescence on the under sides. Wings with a grayish or blackish-gray tint, the veins black. Soda Lakes, Nevada.

This species must strikingly resemble *E. subopaca* Loew, from Connecticut, and it is not impossible that it is the same. The larvæ of two undescribed species of this genus have been taken by Professor Verrill from the sea-water of New England. *E. halophila* Pack. was bred from strong salt brine from salt works in Illinois. *E. gracilis* Pack. was described from larvæ from the great Salt Lake, Utah, where they also exist in great quantities. They will be readily distinguished from *E. Californica* by their greater slenderness and more elongate respiratory tube, which is two-thirds as long as the body or more.

Since writing the above I have had the pleasure of examining, through the kindness of Prof. Riley and Dr. E. A. Barber, specimens of another species of *Ephydra*, most probably *E. hians* Say, sent by Prof. Antonio Peñafiel from Mexico. In a letter just received from this gentleman, he says in regard to them: "Mosca que se encuentre en las orillas del Lago de Tetseoco, y cuyas larvas en cantidades verdaderamente asombrosas se desarrollan en una agua muy alcaline, que contiene grandes cantidades de sesquicarbonata de sosa."